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Engineering Institute Lecture Series

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Los Alamos National Laboratory

Devising Effective Sensor Networks/Detection Algorithms using Bayesian Experimental Design for Structural Health Monitoring

Tuesday, October 23, 2012
3:30 - 5:00 PM
TA-3, Bldg. 4200, 2nd Floor, Room 203A (Los Alamos Research Park Conference Center)

Abstract: Structural health monitoring (SHM) is the process of in-service data acquisition and real-time processing for effectively managing aerospace and civil structural systems with respect to the potential occurrence of damage. Bayesian experimental design deals with the minimization of the expected loss (Bayes Risk) of an experiment or test according to some loss function through modification of the test design parameters. This talk will discuss how a tailored Bayesian experimental design approach can improve, relative to current practice, the development of efficient damage detection algorithms and the optimization of SHM hardware design parameters, such as the placement of sensors. Particular focus will be on the use of networks of piezoelectric transducers for exciting and sensing ultrasonic guided waves in order to actively probe a structure for cracking, corrosion, and loss of bolt preload. With this application in mind, I will present some simulated and experimental results in support of the Bayesian experimental design framework.

Biography: Eric completed his BS in Engineering at Harvey Mudd College in 2005, his MS in Civil Engineering at Caltech in 2006, and his PhD in Structural Engineering at the University of California, San Diego in 2010 as a National Science Foundation Graduate Research Fellow. His dissertation work focused on the development of a Bayes risk approach to optimally placing sensors and constructing optimal detectors and estimators for wave-propagation-based damage detection in structures. Throughout his undergraduate and graduate education, Eric collaborated closely with LANL researchers in the areas of optics and structural health monitoring (SHM). This included leading the development of SHMTools, a software package for rapidly prototyping and testing SHM algorithms. Following graduation, Eric served for one year as the Lead Algorithm Engineer at the Metis Design Corporation, a technology leader in the development of aerospace structural monitoring systems, before returning to LANL as a Director-Funded Postdoctoral Fellow. His current research includes broader applications of Bayesian experimental design, optimization search strategies, and advanced ultrasonic wave measurement technologies for NDE. Eric has authored 16 peer-reviewed journal articles and 22 conference proceedings in structural health monitoring and holds a US patent in the field.

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For more information contact the technical host, Chuck Farrar (farrar@lanl.gov or 663-5330).

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